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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS
FOREST PRODUCTS
FOREST ECONOMICS
RANGE RESEARCH

JUL 1931

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BRANCH OF RESEARCH

July, 1931

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FOREST EXPERIMENT STATIONS

APPALACHIAN FOREST EXPERIMENT STATION

General

On July 15 work was begun on a new group of buildings on the Bent Creek forest. The structures are to face an oval, close to the entrance of the forest, which when completed will be about 750 feet long and 250 feet wide. A road around one end of the oval is finished, and along it will be arranged at the head a small greenhouse with its service house, across the road from it a laboratory, and 100 feet from it on either side two other laboratories. The main driveway to the old buildings crosses this end of the oval, and on the opposite side of this driveway will be a bunk house and a ranger's dwelling facing each other across the oval.

The buildings are all a story and a half in front and all but one are two stories in the rear. The basement stories are built of weathered field stones and the upper stories will be built with exposed upright beams of hand-hewn chestnut and the siding and roofs of hand-riven chestnut shingles. The hardware is to be of hand-wrought hammered steel.

With the exception of the greenhouse, all the buildings, with the water and sewer connections for them, are being built under one contract to be completed September 28, at a total cost of $13,636. About 2 miles of power line are to be built to the site under a separate contract.

Forest Management in North Georgia

With J. T. Kimberly and H. J. Loughead, field assistants, Barrett left the office for Blairsville on July 1. Several days were spent at the Georgia Mountain Experiment Station establishing staked rows in the plantation of 2500 oriental chestnuts made last spring. On account of the irregularity in spacing of both rows and trees in the rows it was necessary to stake each tree and make a map showing the location of each plant. Approximately 20% of the trees in the plantation were measured and described.

The greater part of the month was spent at Camp Soak in the well known Sosebee Cove stand of Yellow poplar. The Georgia party feels sure that it has solved the mystery of the extremely rapid growth made by this stand. Meteorological conditions in the southern Blue Ridge are apparently such that any storm clouds originating in the region head immediately for Sosebee Cove, there to precipitate their accumulation of moisture. Of two weeks in camp, 10 days brought rain.

(Over)

The work on this tract consisted of a boundary survey of the cove and the establishment of permanent strips for the study of growth. The tract was found to contain 13.23 acres. Six permanent chain-wide strips were run through the area at two-chain intervals covering approximately 46% of the total area. This intensity of sampling was considered necessary on account of the presence of 6 major forest types. Strip tallies were kept separate by chain-length units so that each strip represents a continuous series of tenth-acre plots.

The average age of the poplar was found to be a little greater than heretofore estimated, our figures showing it to be 58 ± 5 years. The results of such computations as have been possible to date are shown in the following table:

Forest type	Area		Total volume of poplar*
	Acres	Per cent	Bd. ft.
Pure yellow poplar	4.450	33.61	129,882
Basswood-buckeye-poplar	1.299	9.81	17,915
Cherry-locust-poplar	0.550	4.17	9,250
Chestnut	0.718	5.43	
Chestnut-chestnut oak-black oak	1.280	9.67	
Chestnut-northern red oak-locust	4.933	37.29	
Total	13,230	100.00	157,047

*Scribner Dec. C.

During the month "Forests of Georgia Highlands - Their Importance for Watershed Protection, Recreation and Wood Production," by Hursh and Barrett, appeared as Bulletin 15 of the Georgia Forest Service. The bulletin outlines the result of the work of the Station in north Georgia last fall and winter. Forest conditions are described, the rate of growth of several forest types is given, and treatments to improve the rate of growth are suggested.

Debunking loblolly pine yields

In its issue of August 3 our esteemed contemporary, the Service Bulletin, calls attention to a statement in our May Report of loblolly pine running "five million board feet Doyle scale per acre." We hasten

to correct the statement; it should have read "five thousand board feet." At the same time we are pleased with this evidence that our Report is being so carefully read by the editorial staff of the Bulletin, and call their attention to the stand of yellow poplar cited on a previous page, a part of which runs 29,000 board feet per acre at approximately 60 years of age.

Fire Damage Studies

As part of the study of basal fire wounds in mountain hardwoods Sims and Nelson are developing a technique for studying the insulating properties of tree barks. The method used consists essentially of observing the rise in cambial temperature accompanying the continuous application of a constant temperature to the outside of the bark. Cambial and external temperatures are measured simultaneously at 1-minute intervals by means of thermocouples and potentiometers.

Several methods of placing the thermocouples at the cambium have been tried. Drilling along the cambium proved unsatisfactory because the thermocouple frequently was placed far out in the phloem. In drilling holes obliquely through the wood to the cambium, difficulty was met in determining when the drill just reached the cambium. The most satisfactory method proved to be to peel the bark, place the thermocouple, and tack the bark in place again. One disadvantage common to all methods requiring the drilling of a hole has been that there is no way of knowing, with the wire type thermocouples being used, just where, within the hole, the junction is placed. This is not met with when the bark is peeled since the thermocouple is in intimate contact with the inner surface of the phloem.

Consistent differences in rate of cambial temperature increase have been obtained when the peeling method of placing the thermocouple has been used with yellow poplar bark of different thicknesses. With this species, the cambial time-temperature curves of barks differing in thickness by as little as 0.05" have shown wide divergence when a temperature of 200 degrees C. was applied to the outside of the bark.

During the month Hursh and Genth made observations on soil conditions under virgin forest stands in the Deep Creek section of the Great Smoky Mountains Park. This section of the Park is on the North Carolina side of the mountains and has a rainfall of 50-60 inches per year.

In order to understand the effect of fire and cutting upon forest soil, a knowledge of soil conditions under virgin forest stands is considered to be essential. The Deep Creek region was selected for observation as it includes the most extensive virgin stands of hardwood forests remaining in the Southern Appalachian Mountains.

Observations indicate that under the virgin hardwood stands there exists as a rule rapid decomposition of the litter, accompanied by a loose friable texture of the upper soil layers and showing a high porosity and aeration. These conditions of the soil, generally assumed to be favorable to plant growth, were consistently observed under the virgin stands. They offer a marked contrast to the slow decomposing litter and compacted humus layers generally observed under the cut-over oak types elsewhere in the Southern Appalachians. The high rainfall is considered to be a factor of much importance in governing rate of decomposition provided the seasonal temperatures are also high.

Typical podsolization was not observed; however, in hemlock stands associated with an understory of rhododendron soil horizons sometimes showed a leached horizon under the duff and a moderately well defined deposition zone. At higher elevations under the spruce type and also under the yellow birch stands, indications of some leaching of the surface mineral horizon of the soil were observed. It is probable that a mild podsolization may occur in the Smoky Mountains, but it is of a type not entirely analogous to that occurring in New England, and will require a special study for its interpretation.

Forest pathology

A brief report has been completed by Nelson on the rate of growth and mortality of chestnut sprouts. All except the most vigorous sprout were removed from 100 stumps one or more times a year, and 100 stumps were used as checks. At the end of 4 years there was almost no difference between height growth of the single sprouts and average individual dominants from the 100 sprout clusters. During the same period 88 per cent of the otherwise uninjured single sprouts had succumbed to the chestnut blight.

Forest Entomology

During the month Huckenpahler completed the field data on areas of pine killed by the Dendroctonus frontalis during the last ten years on the Bent Creek forest. On an acreage basis about 5 per cent of the pine has been killed during this time. Each kill has been given a number, and their boundaries noted and definitely tied in to permanent markers. They have also been located on a type map of the forest as a matter of permanent record.

The bark beetles, following a scarcity this spring, have been gradually breeding up in numbers. During the month a few group killings were noted. If the present deficit of 7.40 inches is maintained, it is anticipated that these beetles will be numerous again by fall.

On July 11 some 50 Bhotan white pines (Pinus excelsa)located about some residences around the edges of the Biltmore Country Club were examined for insect attack. It was determined that Ips calligraphus Germ. was attacking these trees. It is believed that these pines were weakened from the effects of last year's drought, and also the continuation of that of this year, sufficiently to attract these beetles which are usually regarded as of secondary importance. None of the native white pines surrounding these trees were affected.

Dr. F. C. Craighead spent the period of July 22 to 28 at the Station, conferring with St. George on the southern pine beetle studies and noting progress made.

Forest Biology

Burleigh observed during the month the first indication of the fall migration at Asheville. Six species of shore birds were recorded.

Burleigh spent the latter part of the month in Washington going over specimens collected by him since January, 1950. Seven species of birds not previously recorded from North Carolina have been added to the State list as a result of his work.

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CENTRAL STATES FOREST EXPERIMENT STATION

General

The field work of the Station was carried on actively. Several changes have occurred in the personnel of the Station. Barrett's vacant place was filled by John C. Kuenzel, Junior Forester. Kuenzel comes to the Station with training at Minnesota and post-graduate work at Yale. He has had experience in Minnesota and the pulpwood forests north of Lake Superior. The position made vacant by the resignation of Mary Jane Winocks, was filled by Charlotte Huston. Appointment has not yet been made to fill the position of Director, vacant September 1 by the resignation of McCarthy, who has accepted a professorship in Silviculture in the New York State College of Forestry, Syracuse, New York. McCarthy spent two weeks in Washington putting in final shape the bulletin on "Yellow Poplar, its Growth and Management".

Woodland Grazing Project Pa-1

During the month of July, Messrs. Diller and Baker established fourteen permanent sample plots in Indiana. These plots were largely

located in woodlands which had been studied either during the reconnaissance phase or during the recovery phase. Mr. DenUyl has given considerable supervision to the establishment of these plots.

On July 1 the Pinney-Purdue project was visited by Day, DenUyl, Chapline, of the Washington office, and Dr. Stanley A. Cain, of Butler University. At that time the animals in the six-acre tract were in such poor condition and the vegetation had been so completely utilized that it was decided that these animals should be given weekly weighings during the month of July. These three animals each lost an average of ten pounds per week during the first two weeks. On the 15th of July, one of the steers was in such poor condition that its removal was necessary to prevent its reaching the point where it could not recover. The remaining two animals lost an average of twenty pounds per week for the following two weeks. On August 1, when the third monthly weighing was made, the remaining two animals in the six-acre tract were removed. Practically one hundred per cent utilization had been effected on all accessible vegetation within the six-acre tract. The area had the appearance of having had a light surface fire run over it.

The animals in the eighteen-acre tract continued to gain during the month. They showed an average gain of thirty-five pounds each. In the twelve-acre tract, the animals gained an average of twenty-three pounds each during the month.

Black cherry and shag bark hickory have been completely utilized in both the twelve and eighteen-acre tracts. The black cherry did not put out a second crop of leaves and it is, consequently, almost entirely defoliated. The shag bark hickory, however, has put out a second and in some instances a third crop of leaves, some of which have thus far escaped browsing. Blackberry has been completely utilized in the twelve-acre tract and about seventy per cent utilized in the eighteen-acre tract. Corylus is approximately fifty per cent utilized in the twelve-acre tract, but has not received much attention in the eighteen-acre tract as yet. Young trees in the twelve-acre tract up to one inch in diameter of black cherry, hickory, elder, and staghorn sumac frequently have been "ridden down" and show evidence of defoliation and browsing as high as eighteen feet on the ground. Dr. Cain and Dr. DenUyl in making some quadrat counts noticed that the animals would frequently team up in this process of riding down trees.

Plantation Project Fp-1

The number of men engaged on this project was increased during the month. A. G. Chapman reported on July 1 to act as chief of party for the crew already working in southwestern Ohio, and a second field party was formed on July 24. It is composed of J. G. Kuenzel, chief, assisted by

Beckert (transferred from the Litter Study.) G. Z. Rayner was assigned by Dr. Hall to accompany this party to secure data on borer damage.

The inspection of plantations in the southwestern portion of the state has been largely completed, and both crews are working into the north and eastern parts of the state.

Damage by the locust borer has been found to be quite inconstant within a small locality. In Clinton County, Ohio, where many plantings occur, injury has been found to vary from a mild attack with little damage, to a complete riddling of the stems. In one planting as many as ten stems have been counted from one original root-system. The killing of the stem has resulted in stump sprouts which in turn have been infected and killed. In Crawford County, two groves were planted in 1905 in beech-maple land. Although only a mile apart, one grove was very slightly attacked and yielded a good crop of posts; the other was very severely injured and only a few posts have been realized. This same situation was observed in Greene County.

Damage by the borer has not been the only ill of planted locust in southwestern Ohio. In some stands there is an immense amount of fungal activity, as evidenced by numbers of sporophores of Fomes (sp.?). As a rule these heavily infected plantings also bear evidence of very severe borer attacks when they were younger stands. It seems very probable that the portions of stems killed by the borers have been easy avenues of entry for the locust rot. The sporophores appear at various heights up to twenty-five feet, and in size range from that of a dollar up to that of a small dinner plate.

About forty-five plots have been taken during July. Of this number about thirty are in pure black locust, three have been other species, and the remaining twelve are mixtures of locust and other species.

In the case of white pine and black locust, it appears that the locust should have been planted later. Although the pine is thrifty and growing, it is overtopped very decidedly and its height is only twenty-five feet to forty-three feet in the locust. Locust was found to be decidedly beneficial to walnut and the heights were not far apart, forty-four and forty feet respectively. In the case of white ash and black locust, heights were found to be about fifty and sixty feet respectively; and in osage orange and black locust, they were thirty and forty-eight feet. All of the foregoing plantings were twenty-two years old.

There are more numerous examples of catalpa mixed with locust. In some cases locust grows faster in height and in other cases about the same rate as catalpa. No plantings have been found where locust was overtopped and it is doubtful if the species will persist under such circumstances.

Two plantings of locust have been found in which erosion control was the motive. Both were successful.

Phenology

Many species are fruiting heavily this year in southwestern Ohio, but there is doubt as to the viability of the seed. Beech trees are carrying a very heavy crop of fruits, sugar, black, and Rugel's maples are all loaded with seed, and honey locust, blue ash, and ironwood are similarly fruiting heavily. Cutting of the immature seeds have shown only a few filled in maple, the ironwood and ash appear filled, but the beechnuts are very empty and some show weevils in the seed.

Black locust has a moderate crop of pods and black walnut has a sparse crop of nuts in this vicinity.

Locust Borer Study

This work is being conducted by Dr. R. C. Hall with two assistant entomologists. These men are working under the direction of the Forestry Division of the Bureau of Entomology. The three men are divided among the three parties operating on the study of locust yield. Thus far it has been found that the locust borer larvae develop best on weakened locust trees such as those which have been previously attacked or are suppressed by shade.

Litter Study M-1

During July, Auten extended his study of soil porosity as influenced by forest litter to second growth and plantations. The study of the past season was confined to a 9-inch column. This season he is taking weights of three, six, and nine-inch columns. The object is to determine the degree and extent to which litter influences soil porosity.

The inclusion of second-growth areas is to ascertain to what degree cutting influences litter and porosity. The results seem to indicate that the porosity of second-growth woods is now much less than that of virgin sites.

A most encouraging fact is brought out in the case of plantations. The litter brings back the loose porous condition in comparatively few years. This is especially true of coniferous plantations. The soil on a 20-year plantation was loose and mellow.

As a corollary to the porosity study Auten is measuring the relative rates of water absorption in woods and cultivated soil; grazed woods, second growth, plantations, and virgin stands. This water absorption is

measured in unit time by means of brass tubes filled with water. The tubes are placed at 1", 3", and 8" depths and the amount of water at 10-minute intervals determined. At 1-inch depth in the woods the rate of absorption is many times faster than at 1 inch in the field or grazed woods, (often 10 to 20 times faster). The rate at 3 inches and 8 inches varies with soil types, but is practically always greater in the woods.

A significant fact is observed with reference to rate of absorption in the 1 and 3 inch depths in the fields. The rate is generally faster at 3 than at 1 inch. A hard, compact, horizon forms at the surface in the fields and causes slow absorption and rapid run-off.

Auten is also gathering samples of soil for determining base exchange calcium loss from forest soils by loss of litter and organic matter through cultivation.

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NORTHEASTERN FOREST EXPERIMENT STATION

Field crews got started on the survey and management inventory of the experimental forests in the White Mountains. In order to make the estimates of cull in the hardwoods reliable several days were taken by members of the field crew for a special study of defect in hardwood logs in the woods and at the sawmill. A large number of logs were found for study on the rollways of National Forest timber sale area and a day was spent at the hardwood mill at North Stratford, New Hampshire, where much valuable assistance was rendered by the chief grader at the mill.

In addition to this, Doctor Spaulding spent several days opening up selected hardwood trees exhibiting exterior defect of various kinds on the Gale River Forest. As a result of this study, a set of rules for estimating cull in hardwoods was drawn up, which should greatly improve the reliability of the estimates for the experimental forests.

On the Gale River Forest a crew of four men in charge of Professor Holdsworth of the Massachusetts State College, is carrying on the inventory work. In order that this survey may be of greatest value in the management of the forest and in obtaining reliable data on growth and mortality, tally is being made of square quarter-acre plots, one corner of each plot being permanently marked with cypress stakes. All trees down to the two inch class are being tallied on these plots and the reproduction is being tallied on a strip of ten milacres extending along one boundary of the plots at right angles to the cruise line. This intensive plan is proving a larger job than first anticipated but we feel that the extra time will be justified by the ultimate results.

The rainy days have been spent making various improvements at the Gale River Station. This includes changing the location of the driveway around the building, constructing cupboards, and painting the entire structure, inside and out.

At Bartlett, Jensen and two assistants have been busy surveying the boundary and topography of the small strip of land necessary to complete the area, which will finally be included in the experimental forest. In addition to this, with the assistance of Ranger Spinney, he has been engaged in running traverse around all of the areas on which fuelwood cuttings have been made in recent years. Because of the varied character of the stand and the number of small operators to whom sales have been made, a considerable portion of the forest presents a rather confused appearance from the management standpoint. The map Jensen is making will locate the cuttings of the various years and will make possible the placement of operations in the future on a more intelligent basis.

In addition to the work on hardwood defect mentioned above, Doctor Spaulding has started on an intensive study of rot in balsam. Several quarter-acre plots have been laid out on the Gale River Forest in stands of varying age and density. On these all the balsam trees are being cut and analyzed carefully as to character and extent of defect.

MacAloney has been working in close cooperation with Spaulding on this job in order to learn whether there is any correlation of the entrance or spread of decay with certain insects.

Later in the season the studies on the Gale River Forest will be supplemented by analysis of older stands on the Cherry Mountain area, and of conditions on the experimental forests of the Finch, Pruyn, and Company near Newcomb, New York.

Arrangements have been made for the sale of balsam pulpwood from the Gale River Forest to the Brown Company, Berlin, New Hampshire.

During the month final agreements with Supervisor Scott and Mr. Evans of Region 7 were reached in regard to a natural area on the White Mountain National Forest. An area of about 510 acres lying in a deep valley on the east side of Mount Whiteface near the southern boundary of the forest will be recommended. This area contains about 5,200,000 feet of virgin softwood timber and 1,000,000 feet of hardwoods. Although a large portion of the area is almost pure spruce on the steep, high slopes, yet the valley contains as satisfactory a representation of hardwoods and spruce and hardwoods as it has been possible to find undisturbed by lumbering. The area is about ten miles south of the Bartlett Experimental Forest in an air line, but about one and one half hours automobile drive is necessary to go from one to the other.

During the month the services of Doctor Guy R. Stewart were secured to start the new planting project. Working on a temporary basis Doctor

Stewart has spent a couple of weeks becoming familiar with conditions and planting practices in the region, and is now starting examinations of representative plantations in New York State.

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NORTHERN ROCKY MOUNTAIN FOREST EXPERIMENT STATION

The outstanding event of July was the reorganization of all Forest Service research work in this Region, and the appointment of L. F. Watts as the director of the new Forest and Range Experiment Station. Late in July both Clapp and Watts arrived in Missoula and concluded final arrangements with the Regional Forester for the new organization.

Under the present plan the station, headed by Watts with fire as his personal project, will continue to carry on silvicultural projects assigned to Weidman and Haig, the previous fire projects conducted by Gisborne and Jemison, new fire projects including the transportation and organization study conducted by L. G. Hornby, W. I. White, and H. R. Richards, and the visibility study already being pushed by J. B. Yule. The office of Products and the new work of the Survey, both headed by Bradner, will be included in the new organization, and L. C. Hurtt, at present supervisor of the Helena Forest, has accepted the position to head the grazing research for which new funds were obtained this year. The total allotment for the new Station, including the Regional office contribution toward some of the fire studies, will amount to over $85,000 a year.

The second outstanding event is the large fire which on August 4 threatens the Priest River Experiment Forest. At 11:00 o'clock this morning this fire is still three miles from the southwest boundary of the Priest River area, but as Thompson just reported over the phone, three miles was a matter of only ten minutes when this fire was making its big run yesterday. One spot fire of 160 acres occurred nearly three miles ahead of the main fire and within one mile of the Experiment Station Lookout.

Major Kelley, Loveridge, and Weidman left Missoula last night for this fire, while five Regional Office overhead men were dispatched by airplane yesterday afternoon. According to Thompson the fire is quiet this morning and three camps, with plenty of men are building line south of the Experimental Forest. The main danger now lies west of the Priest River in the 18,000 acre area burned by the Quartz Creek fire in 1926.

This recent fire is one of several this year which have shown true blow-up characteristics, running miles in a single afternoon and

unapproachable at such times. The weather and inflammability records at Priest River for July 21 to 31 show the reasons for this very clearly and the correlation of these conditions establishes standards which should be of value in the future for determining the degree of prevailing danger, and the need of protection, even when no fires are burning.

Following are some of the ten-day averages for Priest River, first for a clear cut area, then for a fully timbered exposure: Maximum temperature - 90.8°F, 84.8°; 5 p.m. relative humidity - 19.0%, 28.0%; wind movement per day - 54.1 miles, 3.2 miles; evaporation from Bates evaporimeters per day - 23.2 gm, 5.1 gm; lowest duff moisture content - 4%, 9 1/2%; lowest moisture content of two inch diameter wood cylinders - 4%, 8%; average maximum temperature in the surface duff - 140.6°, 83.5°; highest surface duff temperature - 147°, 91°. The remarkable feature of this ten day period and its effect upon fire behavior three days later, is that on July 30 a rain of 0.30 inches was recorded at the control weather station, 0.21 inches on the clear-cut area, and 0.14 inches under dense timber, yet the fuels were so dry before this rain, and the subsequent evaporation rate so great that three days later a fire could make a twelve to fifteen mile run in one afternoon and evening. Obviously the old Regional criterion of 0.20 inches rain being a "Safe Rain," fails to apply more than for the following day.

The recent occurrence of several fires along the N. P. rights-of-way west of Missoula, where nearly all of the engines are now equipped with Cyclone spark arresters, necessitated another test of these arresters late in July. In company with the inventor of this device, the combustion engineer from the St. Paul office of the N. P., and the local road master, Gisborne ran two 100-mile tests of an engine equipped with a Cyclone arrester. The old method of exposing paper lined boxes on top the cars for four-minute intervals along different grades of the track was used, and in addition similar boxes (11" x 5.0') were filled with dead and very dry foxtail grass, with thoroughly decayed rotten wood sprinkled over the grass. These fuel boxes were left exposed on top the second, third, and fourth cars back of the engine for the full 200 mile run. They received an almost continuous shower of cinders. Weather conditions also were ideal for ignition, with a temperature of 90°F, and a relative humidity of 9%, when the run started from Missoula. Not a single fire was started in the fuel boxes, nor a burned spot found on either the paper linings or the canvas covers at the conclusion of this test. These results agreed with former tests of the Cyclone arrester in showing that if it is properly installed on this type of engine even the notoriously sparky Rosebud coal can be used with safety by a good fireman.

Haig spent the month chiefly on mensuration studies partly in analyzing the records of semi-permanent plots and partly in checking and re-writing sections of the yield manuscript. A small amount of work still remains to be done on this report before it is ready for typing.

Williams reports excellent progress in the field on the methods of cutting and reproduction studies with the four man crew now engaged on this work several days ahead of schedule. Quadrat examinations are now practically complete for the Kaniksu plots. As reproduction losses in this year's seedling crop will probably be severe from now on until the fall rains, in view of the high temperatures and low humidities occurringduring the last half of July, it is very satisfying to have the quadrat examinations so nearly finished.

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

General

The Station was favored by many visitors during the month. Among the Department visitors were Chief Forester R. Y. Stuart, W. W. Stockberger who spent a morning at the Station, National Director of the Forest Survey Granger who was here all the month, and Assistant Forester Clapp who arrived July 28.

Fire Studies

Hour Control Studies

Graphic presentation of all computations is completed; the originals and two copies of each chart have been colored and attached to corresponding tabulations. Drafting of the charts has proved to be much more of a job than the computational part of this study, but the charts are necessary to obtain a good picture of the whole hour control situation. With the analyses for individual forests out of the way and similar analyses made for the eastern Oregon and eastern Washington groups of forests, it was possible to spend some time on various other supplementary analyses. These included correlations of speed of attack with strength of attack, analyses by individual years and the like. Analyses of those fires which are responsible for most of the burned acreage indicate that speed of attack is not always the deciding factor; neither is strength of attack in many instances. A good start was made in typing the tables preparatory to writingan office report and one for publication.

Fire Behavior Study

No studies were made of large going fires, but indications are that there will be opportunity for studies of this sort very soon. A new electric oven was made to supplement our present drying equipment for

moisture content determinations. This oven is constructed of asbestos slate 3/8 inch thick and bound with brass. It is 12 x 18 x 30 inches and preliminary tests show that the temperature can be controlled within about 1° F. The cost for materials was less than $50.00.

Static and Lightning Storms

Jacobson repaired and adjusted all existing static meters, made two new meters, and installed them on six eastern Oregon forests and at Wind River. Intensive studies also will be made on the Whitman Forest as soon as equipment can be assembled. Valuable contacts were made at Reed College, with the engineers of the Western Electric Company, Oregon Institute of Technology, and the Bell Telephone Company. The latter organization has made an eleven months' study of static, centering at Portland. For demonstration purposes Jacobson has made a static-indicating device which lights a small light and rings a bell during periods of marked static intensity.

Reporting and Charting Lightning Storms

W. G. Morris, our new junior forester, reported on July 21 and is spending the next few months coding lightning storm data for punched card tabulation, and is also plotting the paths of storm movement. In this latter phase of the study, it has been found necessary to use a map of 1/8 inch to the mile and to consider groups of 4 or 5 forests at a time (original work was done with maps on a scale of 1/2 inch to the mile and each forest was kept separate). In the present analysis the storms for each day are plotted and curved on tracing paper, later to be combined by zones if such zoning appears feasible. By keeping the individual storm days separate, the analyses are much clearer than formerly and are beginning to point toward definite, useful conclusions.

General

Smoke detection studies were made on the Columbia and Umatilla Forests. Similar studies for the Cascade and Deschutes Forests will be made early next month. Final tests of smoke-making materials were completed. Titanium tetrachloride proved to be rather unsatisfactory as a smoke and difficult to handle. When used with creosote as a source of heat, this material was even more unsatisfactory. We are now fully satisfied with the use of the "smoke pots" described in last months's report.

Mensuration

Meyer spent much of July in analyzing the accuracy of the forest survey of Lewis County, Washington. Previous to this time we had little

knowledge of the size of the standard errors accompanying a strip survey in this region, especially if the data were broken up into a number of classes, such as the six divisions in site, the 38 divisions of type, volumes for all the different species, and so forth. Since the primary purpose of the survey was a comparison between two methods of making a survey, that is the strip method involving strips at three-mile intervals versus the compilation method, the calculations were restricted to major divisions of site, type, volume and growth without going into the thousands of possible ramifications and combinations. In order to build up the statistical basis for a computation of standard errors, the tallies, site and type descriptions were divided into nine groups each of which would give an independent estimate of the whole county. Then by studying the variation among these sample subsurveys, the accuracy of the survey as a whole could be gauged.

If for instance the land were divided into site classes expressed in percentage of the whole area, adding up to 100 per cent, the errors of each site area determination ranged from ±.57 to ±3.18 per cent or from 5,200 acres to 28,900 acres. The standard errors for fourteen classes of volume had a minimum of ±10 per cent attached to total volumes of four billion or more feet; for smaller volumes the error usually increased greatly. Only when certain broad groups were made did the errors get as low as±5 to 6 per cent. The lowest error for the 38 recognized types was ±7.7 per cent for an area of 134,496 acres (total area was 904,000 acres), and the highest error was 97.6 per cent on a type area of 153 acres. When the types were grouped by major classes such as total merchantable timber, total unmerchantable forest and total nonforest types, the errors were as low as ±.94, ±1.26, and ±.69 per cent respectively. These various remarks go to show that for an area as small as 900,000 acres, the estimates can not be broken up into many small divisions without running into undesirable errors. The desirable limits are only attained when a few divisions are made, probably at the most about five, or when the total area is extremely large, for instance a whole state.

Silviculture

Douglas Fir Reproduction Studies

During July Isaac completed the spring examination of the 301 semipermanent reproduction plots distributed over the region. In spite of last year's medium cone crop and favorable germination weather during June, he reports a very light crop of 1931 seedlings. On all areas combined the new seedlings about equal the loss on the plots since last year, leaving no net gain for 1931. And once more the cone crop is light on all species. The moist weather in June greatly accelerated the height growth of the brush and vegetative cover on the sample areas. It is estimated as more than double that of last year.

While at Quinault a seedling check was made of the 1929, 1930, and 1931 direct seeding areas where western hemlock Sitka spruce and western red cedar seed was sown. Once more germination was found on all areas and in many instances much more than is needed to produce a stand.

Methods of Cutting, Western Yellow Pine

Kolbe spent most of the month in the field on this project examining and mapping the reproduction transects on the several plots in central Oregon and in the Blue Mountains region. The results of last year's seed crop were found to average in general just a few hundred seedlings per acre with a range in number of plants on the different plots from none to over a thousand. The greatest number of seedlings was found on one of the Deschutes plots which was cut over five years ago. The average number of 1931 western yellow pine seedlings per acre for this plot was 1017. Of this number 38 per cent was found growing under the protection of ceanothus bush and manzanita which covers 7 per cent of the surface, 34 per cent in slash or under logs which covers 34 per cent of the surface, and 28 per cent in the open which covers 59 per cent of the plot area.

Selective Logging in Douglas Fir

Virtually all field work contemplated under the time and cost study phase of the selective logging studywas completed at the end of July. A few minor studies designed to throw light on special phases of log production remain to be done.

The working up of the data on approximately thirty time and cost studies progressed satisfactorily during the month. About half of the work of compilation is being done by manual methods, while the other half is being prepared for the Hollerith tabulating machine. The work of compilation and analysis of data was about 60 per cent complete at the end of July.

Final curves and tables were completed on two studies involving the use of caterpillar tractors in yarding. The results show that in the yarding operation alone the cost varies greatly with variation in the size of log and distance of yarding. It costs three times as much to haul a given load a distance of 3000 feet than over a distance of 500 feet; and it costs approximately 8 times as much to yard and haul logs averaging 100 board feet volume over a given distance as compared to logs averaging 3800 foot volume. On the area studied the extreme variation in the cost of yarding ranged from $0.35 to $7.42 per M.B.M. The effect of the size of log on other items of cost, viz. booming and rafting, main line transportation, spur transportation, and loading, brought the variation in cost (excluding falling and bucking and railroad

construction) from $2.18 per M in large logs (3800 foot B.M. volume) to $21.77 in small logs (100 B.M. foot average volume). On the basis of this range in costs, the operation studied sustained a loss of approximately $1900.00 in taking out approximately 350 M feet in small logs (or 25 per cent of the total volume on the area) the market value of which does not return the costs incurred subsequent to falling and bucking.

A preliminary analysis of the relation between log volumes and tree volumes indicates that approximately 80 per cent of the total amount of unprofitable logs came from unprofitable trees. That is, by anticipating the cost of falling and bucking, selection of trees above approximately 26" D.B.H. would have prevented operating loss considerably over $2000.00 (or roughly, $1.50 per M on the total volume cut). In addition, this procedure would have left standing and unharmed over 50 per cent of the original number of trees over 14" D.B.H. A detailed study of the rate of growth in the trees ranging from 14" to 26" in D.B.H. and which should have been left standing, is under way in order to throw light on the loss in future value due to over-cutting the area in the first cutting cycle.

Forest Insurance

The office workup of the estimates of damage on all the burned areas studied in Washington having been completed, Vose with Litchfield for compassman, left for Coos County early in July and by the end of the month had brought the field work there nearly to completion. This will end field work for the Douglas fir region.

Coos County presents a unique situation because of the occurrence of the high valued Port Orford cedar and a special adaptation of the work to meet the requirements thus imposed is indicated. Shepard spent three days in the field.

During July the climatic study was very nearly brought to completion. Taylor has also been working on the causative hazard study for Tillamook County. It is interesting to note that the same principles as to the incidence of fire are showing up plainly as were demonstrated for Linn County.

A very satisfactory conference was had with E. T. Allen who made some helpful suggestions with respect to the protection grading study, work on which is now being begun. This will be conducted in collaboration with MacDaniels whose intimate familiarity with the problems and accomplishments of protection will contribute highly valuable assistance.

Forest Survey

Early in July Lage Wernstedt took a very successful series of aerial photographs of the south portion of the Siuslaw National Forest. These

pictures, together with those taken last fall, give an almost complete aerial coverage of this Forest which with its bad mixture of types, heavy underbrush, and lack of high ridges from which to get a view, presented a real problem in type mapping.

Mr. Granger arrived on the first of the month and delved thoroughly into the Lewis County comparison of methods, the depletion phase plans, the growth phase plans and the proposed procedure for checking the field work on the national forests. Granger, Matthews, Girard and Andrews spent a week in camp on the Fish Creek compartment in the Umpqua National Forest working out a technic for checking the national forest type maps and volume data.

Mr. Bradner came from Region One toward the end of the month and spent some time in the office going over all phases of the Survey, after which he and Granger went into the field with Kemp, who is type mapping Tillamook County.

Two new check cruisers were put to work early in the month as field assistants. Commercial cruising in the region is at an absolute standstill and any number of very competent cruisers are glad to work with the Survey as field assistants.

Shortly after the middle of the month all computations and recapitulations for both the strip survey method and the so-called compilation method for the west 40 townships in Lewis County were finished. Comparisons of the two methods were made for sites, anticipated growth volumes, and type areas. In the majority of cases the results obtained by the two methods were close. Although many people had no doubt that a strip method would give good results there were many who were doubtful if strips as much as three miles apart, with plots 10 chains apart, would give results comparable with the compilation method on an area as small as 40 townships.

All members of the Survey were agreeably surprised at the way the site data for the area by the two methods checked out. When averaged and weighted the strip method gave an average figure which 1/10 of a site class higher than the compilation method. Statistical analysis of the site data as obtained by the strip method showed that the standard error in per cent varied from (plus or minus) 0.57 for Site V to (plus or minus) 3.18 for Site III.

Growth estimates by the two methods varied by about 10% for board foot growth and 3% for cubic foot growth with the compilation method showing the higher values for board foot growth and the strip method higher values for cubic foot growth. The Survey staff feels that the compilation method has probably slightly exaggerated the growth in board feet due to a tendency in this case to overrate stocking. The strip method showed an annual growth of 108,315,000 board feet for the 578,310 acres of types under 175 years old.

Board foot volumes by the two methods were fairly close with the exception of the hardwoods where, as anticipated, the strip method showed a materially larger amount. The total Douglas fir volume on the area, - and this includes the volume of Douglas fir in all types from 16" DBH to trees often over 80" DBH - by the two methods differed by a little over 11%, with the strip method showing more than the compilation method, which is probably conservative. Without a doubt the strip method shows all the timber there is and automatically includes some timber which is not ordinarily of commercial significance at this time, if ever. For example, the strip method gets the timber on areas already culled and turned in as recent cutovers, on burns which were not completely devastated, on small woodlots and other small patches often passed up by the compilation method. There is a greater difference in the volume of hemlock than of Douglas fir by the two methods. The strip method shows 20% more timber on trees over 20" DBH than does the compilation method. There is reason to believe that the compilation method is low for the total amount of hemlock on the area but is not far off for the hemlock which is of commercial significance at this time.

While pine and live cedar are quite close by the two methods, the amounts of the infrequent species, spruce and of balsam firs, are about 20% apart with the strip method showing more in each case. The volume of hardwoods by the two methods are quite different with the strip method again giving the larger. The strip method undoubtedly gives the facts as to hardwoods but does not automatically interpret them while the compilation method tends to show only those hardwood volumes of most immediate value. It is very difficult at this time in this region to decide what particular combination of amount of hardwoods and their location with reference to roads is necessary before these hardwoods shall be recognized as having value. When the strictly merchantable areas of timber are considered, the two methods are in very substantial agreement on volume, much more so than most ordinary commercial cruises would be for the same area.

The areas of certain types are close by the two methods while for others there are material differences. An analysis of the different type areas as obtained by the two methods showed this difference was generally due to definition. There are fundamental unavoidable differences between type definition in the two methods. In the compilation method the types are of necessity brushed in broadly and big Douglas fir type (40" DBH and up) will include certain amounts of road and water area, patches and stringers of hardwoods, brush areas, certain small patches of hemlock and other non-Douglas fir types too small to map in place. Although these areas of alien types add up to a considerable per cent of the total of any unit mapped as big Douglas fir, they are not individually large enough to be designated as separate types by the compilation method. The strip method as applied in Lewis County squeezed out all the extraneous types from the big Douglas fir type, showing the acreage of this type itself. The differences in type areas by the two methods represents a certain amount of give and take between types and, as stated before, this is largely a

matter of definition. As timber types are mostly useful in figuring volume and growth and inasmuch as volume and growth figures showed no material differences by the two methods, the give and take between types apparently made no difference.

After thoroughly analyzing, statistically and otherwise, the comparison of the results by the two methods, and after a series of conferences, in the last of which Mr. Clapp participated, it was decided that the compilation method would give satisfactory results and the survey is continuing with this method as originally started. The comparison of methods showed ways in which the compilation method could be strengthened and steps are being taken to refine the procedure.

All members of the Survey are now back at the regular routine of check cruising, mapping in place and other work connected with the Inventory phase.

Section of Forest Products

Minor Forest Products Study

The bulk of Johnson's time was devoted to working up the field data in connection with the minor forest products study. In this connection, it was found that the total comsumption of "forest" fuelwood in Oregon and Washington in 1930 amounted to 1,798,076 cords valued at $10,036,969 or $5.58 per cord. The following table shows the amount by states and subdivisions in the states.

Subdivision	OREGON		WASHINGTON		Total No. of cords	Total Value
	No. of cords	Value	No. of cords	Value		
		Dollars		Dollars		Dollars
Urban	316,235	1,952,552	230,598	1,466,955	546,833	3,419,507
Rural	606,367	3,088,185	605,908	3,298,039	1,212,275	6,386,224
Schools	22,671	137,088	16,297	94,150	38,968	231,238
Total	945,273	5,177,825	852,803	4,859,144	1,798,076	10,036,969

The consumption is shown for each state under the captions "urban" which includes only incorporated cities and towns, "rural", and "schools". The latter includes schools, granges, and lodges outside of incorporated places. It will be noted that the consumption in Oregon was nearly 100,000 cords more than in Washington, most of which is in urban consumption. This difference is especially significant since Oregon has about 600,000 less population than Washington indicating that the per capita consumption is much greater in the former state, amounting to 0.99 cords in Oregon and 0.55 cords in Washington.

Douglas fir supplied 77 per cent of the wood, or 1,396,433 cords; western yellow pine about 12 per cent, western larch 4 per cent, oak 3 per cent, with remaining 4 per cent largely made up of red alder, western hemlock, lodgepole pine and western juniper.

Mt. Emily Mill Scale Study

The working up of the Mt. Emily mill scale study data has been completed and a report prepared by Rapraeger. This study was based on 2,166 western yellow pine logs, scaling 299,750 board feet.

The study showed that over-run increased with log taper. For example, 16-foot sound logs with a taper of 1 to 2 inches showed an over-run of 22.5%; with 3 to 4 inch taper, 25.5%; and with 5 inch taper, 35%. The average overrun for sound logs was 21.4%.

The study also showed that the practice of turning down small logs is apparently better practice than sawing alive. For a 9-inch diameter, 12-foot log the sawing cost was 12 cents higher when turned down than sawing alive, but the value of the lumber recovered was 21 cents more. In the case of 12-inch, 16-foot logs, the sawing cost turning down was 13 cents higher, but the value of the lumber was 68 cents more. This is probably due to the greater waste in edgings when sawed alive than when turned down. Also in turning down there is greater opportunity to saw for grade and less waste occurs from the outer and more valuable portion of the log.

Felling Breakage Study

The purpose of this study, which is a continuation of the felling and bucking study, is to determine the influence of human skill, topography, and tree size on breakage in felling. Rapraeger spent about two weeks at the camp of the Crown-Willamette Pulp and Paper Co., Cathlamet, Washington during the month. So far the breakage in felling around 500,000 board feet of western hemlock and white fir timber has been studied. Rapraeger expects to cover a number of camps, embracing a variety of personnel, topography, and sizes and species of timber.

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SOUTHERN FOREST EXPERIMENT STATION

General

Demmon left New Orleans July 25th for a three day trip to Lake City, Florida. During this time he inspected the work of Averell and party on

the Olustee tract and discussed the work at Camp Pinchot with Gemmer. Demmon spent most of the balance of the month on the analysis of fire data.

Station visitors during the month were: Professor D. M. Matthews and Mr. Norman L. Munster, of the University of Michigan who were particularly interested in the bottomland hardwood region. They spent several days with the hardwood survey crew at Lake Providence and took a short trip in the bottomland region with Winters. Dr. Richards, of the Forest Products Laboratory, Madison, Wisconsin, spent several days with Mr. Lindgren and other men working on the sap-stain study. Professor Fay Clark, of the University of Montana, and Mr. Olsen, Forestry Student at Ames, Iowa, also paid the station a visit. Professor Dow V. Baxter, of the University of Michigan, spent one day at the New Orleans office and took a short trip with Winters through a portion of the bottomland hardwood region. Baxter was particularly interested in securing samples of lumber showing wood-rot.

During the month, the following personnel assignments were made: Mr. F. W. Bennett and Mr. F. K. Beyer have reported for work on the forest survey. Mr. C. A. Bickford has been assigned to silvicultural studies. The pathological work of the forest survey has been inaugurated by Dr. L. O. Overholts, who has been assigned to this station for a short detail. Mr. F. Kaufert is at present working with Dr. Overholts and will continue the pathological phase of the hardwood survey work.

Management

During the first half of July Wahlenberg and Spillers worked in cooperation with H. C. Mitchell, Assistant State Forester of Mississippi, on Extensive Surveys in Alabama, Mississippi, and Louisiana. The primary object of these surveys was to determine the effect of fire, particularly annual fires, on the establishment of longleaf pine. The latter half of the month was spent in office analysis and summarization of these data.

Chapman spent the entire month on the office analysis of the Urania sample plot data.

Naval Stores

C. F. Olsen took over the interval of chipping test on the first of July, in place of Busch who was transferred to the Osceola Forest. Tins were raised on this test in the daily and three times a week groups. Scrape also was removed on these same trees. The other groups will not have tins raised nor scrape removed until the end of the season.

The third dip was made on all test trees. The advance streak trees and the check group are now nearly on a par in gum yield although those with an advance streak did better in the first two dippings.

An exhibit showing representative uses for naval stores and products using naval stores in their manufacture was prepared. Wyman gave an illustrated lecture on turpentine methods at the Ninth Plant Science Seminar in cooperation with the American Association of Pharmacognocists at the University of Florida.

Professors Shealy, Stokes and Camp of the University of Florida, came to look over some unburned range near Starke to get at the effect of burning on forage amount and composition.

Olustee Tract

During the month Averell, Heyward and Diller finished the survey and subdivision of the Olustee Experimental tract. Averell laid out several one quarter acre thinning plots and supervised the construction of fire lines on the area. The fire lines were constructed by two negro laborers and the costs were as follows:

5 ft. fire line	$ 8.50 mile
2 ft. fire line	5.00 mile

Forestation

Wakeley has practically finished the computations pertaining to this year's seed tests. As one phase of these tests, Wakeley sent matched samples of seed to nine cooperating seed testing agencies. These agencies include the Bureau of Plant Industry, the Lake States Forest Experiment Station, five different forest schools, one private research institute, and one commercial seed testing concern. Wakeley reports that tests from these several agencies have revealed germination percents for slash pine, which varied from 3% to 95%. The germination energy period varied from three weeks to four months. Wakeley feels that a comparison of the results obtained by the several agencies has lead and will continue to lead to an improvement in seed germinating technique on the part of this station.

Wakeley also began the compilation of a comprehensive report on the Great Southern Lumber Company's south pasture at Bogalusa, Louisiana. This report purposes to summarize the history of cutting, fire, and disease on approximately 5,000 acres, reproduced naturally to longleaf pine.

In his spare time, Wakeley also completely reorganized the forestation files in order to simplify future filing and to facilitate current work on the forestation bulletin.

Protection, Grazing

Student Assistant Watkins continued to take meteorological readings at McNeill, Mississippi. He does not report upon the present condition of

the rain gauges, but from the fact that on July 15th, fifteen inches of rain fell between 8 a.m. and 2 p.m. it may be inferred that they were taxed to the limit.

Dr. Pessin, assisted by Beyer and Bennett, made reproduction counts on a railroad right-of-way that has been winter burned annually for 49 years. In addition to the winter burning, all seedlings have been annually cut back in order to keep the right-of-way open. In spite of this treatment, a cursory preliminary examination of the results indicate that longleaf pine reproduction persists under this type of treatment. The number of seedlings and sprouts per acre actually counted under these conditions varied from practically none to approximately 900 per acre.

Ecology

Dr. Pessin visited the summer laboratories of the Louisiana State University, at Grand Isle, in order to inspect the work done by a graduate student on the roots of live oak.

Financial Aspects

Dr. Ziegler spent 3 weeks on leave, visiting the Washington Office for a review of the Appling County, Georgia, and Washington County, Florida Reports, and the Capper Report Revision data for the Gulf States.

Bond and Reynolds, with cooperation from the Texas State Forester's Office, completed the field work of the Financial Aspects Survey of Polk County, Texas. Very good cooperation from the land owners and forest industries was secured. The county increment was secured by a strip survey of the county. In addition, Stand and Growth data were secured on 76 farms for a cooperative agricultural and forest farm income study with the Texas Agricultural Experiment Station, Dept. of Economics.

The Extensive Survey Revision Data (Capper Report) first draft was forwarded to Washington. A revision of the figures for the stand of longleaf pine in Mississippi will be made since important check figures have been secured on the total stand still held by reporting companies. A large disagreement from the figures of the Southern Pine Association (just published) on the total stand of longleaf pine cannot be reconciled. The figures for shortleaf pine are remarkably close in the two estimates.

Erosion

The work for the month of July consisted in the establishment of catchment tanks on cultivated land near Holly Springs, Mississippi. A certain amount of difficulty has been experienced in securing the satisfactory construction of tanks and other specially made equipment. As a result, a

certain amount of Moginnis' time has been spent in conference with equipment manufacturers in order to make certain that the equipment will be delivered according to the specifications.

Forest Survey

Putnam, Lehrbas, Wheeler, and Faulks spent the month at Lake Providence, Oak Grove, and Ferriday, Louisiana, securing the volume table measurements to be used in the construction of volume tables for the hardwood survey. Putnam reports two rather unusual cottonwoods that were found on the banks of Black River near Ferriday, Louisiana. These trees were 72 years old, were 112 and 121 feet high, had diameters, breast high of 44 1/2 and 45 inches, and scaled approximately 1,800 board feet apiece.

Lentz and Bull left New Orleans early in July for a detail in Washington to assist in the computation of the data obtained in the preliminary survey of East and West Carroll Parishes, Louisiana.

Hardwood Growth and Yield

During the month Winters and members of the hardwood survey crew measured approximately 100 trees of bottomland species in an attempt to test the suitability of form 558 (a) for use in volume table construction for these species. Check diameter measurements were taken at approximately 4-foot intervals above a point 8.15 feet above ground. Below this height, measurements were taken at 1.5 or 2.0 foot intervals in order to more accurately measure the influence of butt swell. Limb wood was measured by recording the mid-diameter of pieces 4 feet long, providing this mid-diameter was more than 4 inches outside bark.

The office plan calls for the cubic volume determination of the main stem in the usual way, using form 558 (a). The check will be effected by cubing the main stem in 4 foot (smaller in the region of butt swell) sections by Smalian's formula. The volume of limb wood determined by multiplying the cross-sectional area of the mid-point of the 4 foot pieces by four will be added to the volume of the main stem in either case.

Some time was spent in testing the usefulness of a monocular field glass having an etched scale inserted between the lenses, for determining the upper diameters of standing trees. This work was done cooperatively with the men working on the hardwood survey. Measurements on certain sizes of trees and uncommon species are difficult to get for use in the construction of the volume tables to be used in the hardwood survey. Since the Liljenstrom dendrometer is a rather cumbersome instrument, a simple, yet satisfactory measuring instrument was sought. Preliminary results indicate that the glass is sufficiently accurate if diameters accurate to .5 - .8 inches are satisfactory. Since the cross-section of the stems

of many of the bottomland species is very irregular and calipered diameters often vary by this amount, the glass is felt to be satisfactory.

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SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION

All the field stations report a large amount of work in finishing up the emergency improvement program. At the Jornada, a road gravelling contract is about completed, and the bachelor's quarters, also under contract, are being constructed. At Fort Valley all the construction and maintenance work is completed except for cleaning up and a few minor jobs which are being handled by the ranger-foreman.

The summer rains, after an erratic start, seem to be well under way. Even Tucson is getting good showers, including one of .8 inch. In the Flagstaff region good rains fell during the last half of June, with the result that the grass greened up and pine seedlings took a new lease on life at a time when the drought is usually at its height. During July the precipitation was far below normal, but it was sufficient to keep vegetation growing. Despite the fact that precipitation since January 1 has been deficient, range conditions are better than average. During the last week of June and first week of July in 1930, second-year pine seedlings died on an enormous scale; this year losses were generally light.

The Jornada reports livestock in excellent condition, with no losses. Feed is plentiful, though the main forage crop has been slow in developing because of deficient precipitation.

At the Fort Valley station, Hornibrook devoted most of the month of July to mapping the experimental forest. In addition to continuing the contour map begun last year, he has made several strip surveys, sketching in tree crowns and reproduction in order to give a clear idea of distribution and to furnish a record for future reference. These strip surveys cover areas on which advance reproduction is regarded as complete, and adjoining areas on which it is deficient or completely lacking.

Krauch is on the Lincoln making a preliminary study of the Douglas fir reproduction problem, preparatory to formulating a working plan for this project. He has checked up seedling plots established 5 years ago on areas cut under different methods. A few seedlings several years old at the time the plots were established are still surviving, but all the one year seedlings recorded at that time and entered since have died. One of the obvious requisites in the Douglas fir study is more frequent examination in order to ascertain when the seedlings die and the causes.

A serious water shortage is being experienced in the Flagstaff region. The City of Flagstaff was obliged to ship in water during May. The city spring is now supplying current needs, but is not filling the reservoirs to tide over next winter. The Fort Valley well has been low ever since early spring whereas in former years the water level has always remained high until mid-summer. Other wells in the valley are almost dry. The shortage is difficult to explain. Precipitation records alone do not furnish the answer. Possibly it is because the ground was almost bare of snow during a long cold period last winter. The ground may have frozen so deeply that when the spring thaw came most of the water ran off instead of going into the soil. The relation of climate and other factors to underground water resources is a subject that might well receive the attention of this station. In the last analysis, are not the many small water sources which mean life or death to towns and communities of greater importance to the Southwest than the storage of flood waters for immense irrigation projects? Putting water into the soil means more springs, more live streams, and better growth of timber and forage. Yet, when we speak of water resources in the Southwest, we usually think of irrigation projects for growing alfalfa and cotton.

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RESEARCH ACTIVITY IN REGION 2

Roeser was called to the Denver office on the first of the month to check the data to be presented in the growth section of the Extensive Revision of the Capper Report. Two days were occupied in attending to this task. The final report, upon which Mr. Donery of the Office of Management assisted by Mr. Higgins has spent most of his time since the report was requested early in the year, is now nearing completion.

During the period July 13 to 18, Roeser, accompanied by Technical Assistant H. D.Petheram of the Pike Forest staff, visited the artificial reproduction and grazing and erosion protection plots near South Platte on the Pike Forest. The purpose of this year's visit was to conclude the series of periodic examinations begun last year, when erosion observations were made and new erosion points established. During the recent examination, the vegetation was listed and platted for eighteen vegetation quadrats, and measurements and survival counts were made on eight growth study plots to determine the process of development of the planted western yellow pines. Unlike at the previous periodic examination, when a pronounced difference in the development of the herbaceous flora was noticeable inside the fenced area as compared with the unfenced area, a severe winter and spring drouth had left the vegetation in such poor condition as to obscure any beneficial effect which may have resulted from protection.

In studying the planted trees, interest was centered largely in determining the amount of porcupine damage. While porcupine injury was found to have been inflicted upon a large majority of the trees, fatal results were attributable to such injury in a smaller percentage of instances than was deemed the case following cursory inspection. However, it is obvious that the activity of porcupines tends to minimize or nullify the influence of the planted stock as a factor in erosion protection, since it seriously inhibits normal development and greatly delays the formation of a secondary ground cover, whose development, at best, is a slow proposition under the unfavorable edaphic conditions which prevail on the experimental area. At any rate, the remedy to the situation apparently does not lie so much in replanting as it does in suppressing the porcupine, whose activities are all the more destructive within the plantations because of the very limited number of native pines to supply natural food material on the site of the extensive burn in which the plots are located.

An encouraging feature in the situation is the comparative meagre amount of recent damage noted in the inspection of the study plots. Poison blocks were put out last year in a campaign to eliminate this destructive rodent and only infrequent evidence of 1930-31 browsing was detected. This indicates, however, that the campaign of elimination must be continued to become fully effective.

Research activity at the Fremont Branch Station was largely confined to the local M-1 project under which the progressive development of the demonstration forest from a virgin into a sustained yield forest is being accomplished. Two .92 acre plots, B-8 and 19, were marked and measured to be included with four others upon which this year's cutting is to be concentrated. In addition, one plot in ridge-type Douglas fir, was inventoried and reserved as a virgin area. As occasion permitted, some cutting was also done, but the bulk of this work will be done this fall, during which period the final clean-up of the second of the three management units (Block C) will be undertaken.

The relative absence of visitors and the prolonged drouth, which was not broken until the last day of the month, enabled the Station staff to procure a maximum return in effective accomplishment during the month. The above mentioned drouth was the most severe July drouth experienced in the twenty-two years' history of the local weather station, and added another record breaking performance to the large list built up by the capricious local climate during the last two years. During the period of the drouth, the fire hazard for central Colorado Forests was very high. Because of abundant spring and June rainfall, local vegetation suffered little in spite of the 55% precipitation deficiency in July.

A full complement of meteorological observations was procured at the 15 Fremont Stations in the type influence study (T-1). Because of

the extraordinarily dry and warm weather, interesting data were obtained in connection with the surface temperatures, evaporation, and soil moisture phases of the experiment.

The set back experienced by Douglas fir within the Pikes Peak region in general and on the Fremont Experimental Forest in particular, as the result of the extensive winter-killing of shoots and frosting of buds during the late winter and spring of 1930, becomes more obvious daily. On two experimental plots, approximately one-half of the trees give every appearance of eventually succumbing to the injury or at least retrogressing into stag-headed individuals. As a rule, new growth in 1931, even though very good on normally developing trees, has been meagre on trees especially hard hit and confined largely to the lower branches. As the growing season begins to wane, the tops of a large number of the trees appear to be dying. Peculiarly enough, this winter-killing was quite uniformly experienced by all age classes; if anything, it seems to have been most severe in thrifty, more rapid developing individuals approaching maturity. The effect of this extensive damage upon the development of woody tissue would constitute a very intriguing line of study, which unfortunately, cannot be attempted under present working conditions.

It might be mentioned incidentally that the highest percentage of germination procured in tests of the seed representing the meagre crop of the 1929 season of six local Douglas fir trees was 3.05%. The seed of four of these trees did not germinate at all. Since only a small amount of seed was available for testing, these data may not be very significant, but they appear to indicate that the stringent inhibition of physiological activity and vegetative development left its mark in the quality of the resultant seed crop.

On the evening of July 21, Roeser described, in general, the work of Research in R-2 at one of the seminar meetings held by Dr. F. E. Clements at the Alpine Laboratory of the Carnegie Institute of Washington.

The final report of the "Resistance of Seedlings to Excessive Heat" project was returned during the month after review by the Washington office and will be worked over to put it in shape for publication.

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MANUSCRIPTS

APPALACHIAN

A Community Woodyard, by J. H. Buell (For American Forests).

SOUTHERN

Some Observations on Southern Pine Seed, by P. C. Wakeley, (Read before Gulf States Section of the S.A.F. at New Orleans, March, 1931).

PACIFIC NORTHWEST

Report on Mt. Emily Lumber Company Western Yellow Pine Mill Scale Study.

IN PRINT

Barrett, L. I.	Influence of Forest Litter on the Germination and Early Survival of Chestnut Oak, Quercus montana, Willd. (Ecology, July, 1931).
Bolles, W. H.	Afield with a Forest Ranger (American Forests, July, 1931).
Hodgson, A. H.	Sawmill "Waste" and its Present Utilization in the Douglas Fir Region of Oregon and Washington (Serially in The Timberman, beginning July, 1931).
Hursh, C. R. and Barrett, L. I.	Forests of Georgia Highlands, their importance for Watershed Protection, Recreation and Wood Production. (Bulletin 15, Georgia Forest Service).
Hursh, C. R.	Abandoned Mountain Farms an Erosion Menace but an Opportunity for Forestry. (Farmers Federation News, August 1931).

OFFICE OF FOREST PRODUCTS, R-1

Timber Survey

Mr. Bradner is in Portland at the present time conferring with Mr. Granger and members of the Forest Survey personnel of the Douglas fir region. Methods and procedure for the Inland Empire survey are the principal issues to be settled at the conference. During the past month Mr. Bradner spent considerable time in compiling and adjusting timber estimates of the larger Inland Empire operators for Mr. Morrell's use in the sustained yield forest management study which is being carried on by the United States Timber Conservation Board.

Summary sheets for Montana and Idaho for the extensive revision were received from Washington on July 27. Copies have been presented to State Forester Rutledge Parker, Dean T. C. Spaulding of the University of Montana Forest School and Roscoe Haines of the Anaconda Copper Mining Company. A personal contact was made in each case and the source method compilation of the data thoroughly explained.

Breakage Study

About three weeks of office work will be required to complete the office analysis of the data. A compilation of the white pine data by cause of breakage shows the following division of breakage losses by causes; bucked logs 39%, windfalls 35%, stumps 6%, rocks .3% and miscellaneous 19.7%.

Contrary to popular belief, breakage in frozen timber in the western white pine, western yellow pine and larch-Douglas fir types was found to be practically the same as for unfrozen timber. Snow which is normally on the ground when frozen timber is felled, acts as a cushion and offsets excessive breakage that the frozen condition of the timber might cause. Over a half million feet of white pine scaled at one of the camps of the Potlatch Lumber Company during temperatures ranging from 32° below zero to 10° above zero showed a breakage of 2.2% of the gross volume of the trees. The timber averages 6 logs per M net log scale and was 14% defective.

Data for the western white pine and western yellow pine types have been analyzed to show breakage by diameter classes for the following variables; causes, felling data, i.e., slope, direction tree felled, etc., condition of timber (frozen or unfrozen), log length classes, age and character of ground. The same data have been analyzed for all diameters combined for the above variables.

Co-operation with School of Forestry, University of Idaho

Statistical information on the lumber and timber products industries of Benewah County, Idaho, for the years 1928 to 1930, inclusive,

was compiled and sent to Dean F. G. Miller for use in his report of a reproduction survey of this county started in 1928. The information supplied on July 10 was requested by Dean Miller in order that similar tables furnished by this office in December, 1928, could be extended and brought up to date.

Lumber production in Benewah County, Idaho, reached its peak in 1923 and for the past five years has shown a marked decline. Since 1923, at least 9 sawmills with a combined capacity ofabout 300 M feet per 8-hour shift, have gone out of business as the more accessible sawlog stands have been cut. The shrinkage in output and in revenues from sawmill operations in this county where lumbering has been the principal industry, is partially indicated by the following summary:

Year	Total lumber production M Ft. B.M.	Total value all products reported by sawmills	1/ Expenditures all sawmill operations	1/ Number of persons employed
1923	108,243	$ 4,111,303	$ 3,359,102	1933
1924	99,342	3,095,749	..	..
1925	91,208	3,044,369	2,491,242	827
1926	58,809	1,776,808	..	..
1927	43,507	1,226,400	1,083,587	357
1928	43,286	1,056,053	..	..
1929	28,616	859,754	620,249	325
1930	22,420	644,792	..	..

1/ Figures available biennial census years only.

While the sawmill output has declined quite rapidly during the past eight years, production of cedar poles and other miscellaneous timber products has remained fairly constant with an actual increase in volume for 1929 as compared with 1923.

In 1929 the total value of miscellaneous products reported from the six operations in Benewah County not conducted in conjunction with sawmills amounted to $1,579,105 with 465 persons engaged. In 1925, the aggregate value of all miscellaneous products was $627,287, with 171 persons employed.

Fire Detail

Mr. Anderson and Field Assistant Wm. Ibenthal were on fire detail from July 12 to July 30. Eleven days were spent on the Gold Creek fire on the Bitterroot Forest and eight days on the Silver Lake and Barker Creek fires on the Deerlodge Forest. In spite of a rather general rainfall extending from western Montana eastward beyond the Continental

Divide the fire situation is critical. In anticipation of the need for overhead on new fires Anderson and Ibenthal have been held in the Regional Office for the past few days.

Mr. Whitney was detailed to the Rock Creek fire on the Lolo Forest on July 11 and remained there until July 22 when the fire was well under control.

Lumber Prices and Movement

Average Mill-Run Prices	Annual, 1930	1st Q., 1931	April, 1931	May, 1931	June, 1931
Idaho White Pine	$33.56	$31.41	$30.63	$31.91	$30.74
Western Yellow Pine	21.64	19.25	19.95	19.50	19.09
Larch-fir	17.32	14.26	12.95	13.81	13.98
White fir	16.34	13.76	13.92	13.53	13.95
Spruce	21.93	18.39	19.26	19.29	17.52

Shipment and Cut	1930	1931
Shipment	120,900	95,536
Cut	154,774	114,062